Flower Dome Station A – The Baobabs
Suggested Solutions

Question 1

Question 2a
Diameter
= 152 to 164 cm

Question 2b
Radius
= 76 to 82 cm

Question 2c
Height
= 19 to 20 cm

Question 2d
Volume
$= \pi \times 76^2 \times 19 = 345\,000\ \text{cm}^3$ (3 s.f.)
to
$= \pi \times 82^2 \times 20 = 422\,000\ \text{cm}^3$ (3 s.f.)

Question 2e
Exposed area
$= (\pi \times 76^2) + (2 \times \pi \times 76 \times 19) = 27\,200\ \text{cm}^2$ (3 s.f.)
to
$= (\pi \times 82^2) + (2 \times \pi \times 82 \times 20) = 31\,400\ \text{cm}^2$ (3 s.f.)

Question 2f
Cost
$= 27\,218.758\,75 \times \$0.01 = \$272.19$ (nearest cent)
to
$= 31\,428.492\,91 \times \$0.01 = \$314.28$ (nearest cent)

Question 2g

1. The wooden object is cylindrical.
2. The volume and top surface area of the gap is negligible.

Question 3

1. All species have 'caudiciform' stems, which are swollen to store water.
2. Lose their leaves during dry season.

Question 4a *(sample photo)*

Question 4b

They have a dry, stone-like appearance that allows them to blend in with their surroundings, camouflaging them from predators.

Question 5a

The silky hairs are collected to make pillows and cushions.

Question 5b

The flowers of the ‘Drunken Tree’ are made into tea to cure headaches.

Question 6

The snake plant’s copper coloured leaves look as if they were diseased or even dead, thus avoiding attacks from herbivores.

Flower Dome Station B – Succulent Garden
Suggested Solutions

Question 1

	Thick skin / waxy surface	Ribs	Hairs, bristles and spines	Produces spines instead of leaves
Helps to ensure that sunlight reaches different parts of the stem to help it cool down.	○	◉	○	○
Protects the plants against animals.	○	○	○	◉
Provide shade. Reflect sunlight and reduce water loss.	○	○	◉	○
Protects underlying tissues from excessive sunlight.	◉	○	○	○

Question 2a

Perimeter

= Arc length *BC* × 2

$= \left(\frac{1}{4} \times 2 \times \pi \times 10\right) \times 2$

$= 10\pi \text{ cm}$

Question 2b

Surface area

= (Area of quadrant *ABC* – Area of triangle *ABC*) × 2

$= \left(\frac{1}{4} \times \pi \times 10^2 - \frac{1}{2} \times 10 \times 10\right) \times 2$

$= 57.1 \text{ cm}^2 \text{ (3 s.f.)}$

Question 3a

Volume

$= \frac{4}{3} \times \pi \times 22 \times 22 \times 22$

$= 2030 \text{ cm}^3 \text{ (3 s.f.)}$

Question 3b

Volume of water

$= 2\,027.374\,459 \times \frac{90}{100}$

$= 1\,824.637\,013 \text{ cm}^3$

$= 1.82 \text{ litres (3 s.f.)}$

Question 4a

The wooly cactus has golden spines and lateral wooly flowering region, of cephallium, to protect the flowers from drying out in the hot desert sun.

Question 4b

The wooly cactus' smelly flowers.

Flower Dome Station C – Australian Garden
Suggested Solutions

Question 1
1. Fire-resistant bark
2. Lignotubers that develop into shoots after fire
3. Flowers more profusely once it has burnt
4. Regrowth from underground structures or carefully protected buds

Question 2a
Number of lines of symmetry = 5

Question 2b
Number of lines of symmetry = 3

Question 3a
Diameter = 0.98 m

Question 3b
Diameter = 1.25 m

Question 3c (i)
Area of square mirror
$= 0.98 \times 0.98$
$= 0.9604 \text{ m}^2$

Question 3c (ii)
Cost of square mirror
$= 0.9604 \times \$84$
$= \$80.67 \text{ (nearest cent)}$

Question 3d
Area of border
$= (\pi \times 1.25^2) - (\pi \times 0.98^2)$
$= 3.95 \text{ m}^2 \text{ (3 s.f.)}$

Question 4a
Obtuse Angle

Question 4b
Reflex Angle

Flower Dome Station D – South American Garden
Suggested Solutions

Question 1a
~ 3.4 m

Question 1b
Around 2 times the height of a 1.7 m tall person.

Question 2a
Radius = 75 cm to 90 cm

Circumference
$= 2\pi(75) = 471.239 \text{ cm}$
to
$= 2\pi(90) = 565.487 \text{ cm}$

Question 2b
1. Count the number of steps needed to walk around the trunk.
2. Use a rope to wrap around the trunk.

Question 3a
1. Sap can be fermented into a palm wine.
2. Sap can be concentrated into a sweet syrup (palm honey).
3. Edible fruits are harvested and eaten fresh.

Other Answers for Question 3a
- *Edible fruits are harvested and made into jam.*
- *Its leaves can be woven into baskets.*

Question 3b
Number of wine bottles
$= (300 \times 1000) \div 750$
$= 400 \text{ bottles}$

Flower Dome Station E – Olive Grove
Suggested Solutions

Question 1a
It is monosaturated, and the extra-virgin type has a high level of anti-oxidants.

Question 1b
Used in the cosmetic and medicinal industries to manufacture skin care products.

Question 2a (i)
Vertical height
$= 15 \text{ cm} \times 13$
$= 195 \text{ cm}$
$= 1.95 \text{ m}$

Question 2a (ii)
Measure the height of 1 stair, then multiply by the number of stairs travelled vertically.

Question 2b (i)
Horizontal distance
$= 30 \text{ cm} \times 13$
$= 390 \text{ cm}$
$= 3.9 \text{ m}$

Question 2b (ii)
Measure the width of 1 stair, then multiply by the number of stairs travelled horizontally.

Question 2c
Fraction
$= \frac{1.95}{3.9}$
$= \frac{1}{2}$

Question 2d
It represents the gradient / steepness of the lower half of flight of stairs.

Question 3a
They can live to 2000 years old.

Question 3b
$2019 + 25 = 2044$

Cloud Forest Station A – @Entrance
Suggested Solutions

Question 1a
Triangle A

Question 1b
Measure all the sides and ensure that there are 2 equal sides.

Question 2

	(a)	(b)	(c)	(d)
Has flowers	☑	☐	☐	☐
Algae	☐	☐	☐	☐
Bromeliads	☐	☐	☑	☐
No true roots, stems and leaves	☐	☑	☐	☐
Ferns	☐	☐	☐	☑
Fungi	☐	☐	☐	☐

Question 3 *(sample photo)*

Cloud Forest Station B – Along the Foothills
Suggested Solutions

Question 1a
73 cm

Question 1b
150 cm

Question 1c
167 cm

Question 1d
$\frac{1}{2} \times 73 \times 150 = 5475 \text{ cm}^2$

Question 1e
$73^2 + 150^2 = 27\,829$
$\approx 28\,000$ (2 s.f.)

Question 1f
$167^2 = 27\,889$
$\approx 28\,000$ (2 s.f.)

Question 1g
$AB^2 + BC^2 = AC^2$

Question 2a
9

Question 2b
144

Question 2c
625

Question 2d
1681

Cloud Forest Station C – Before the Lift to the Lost World
Suggested Solutions

Question 1

1. Shorter trees and shrubs
2. Smaller and thicker leaves
3. Mossier surfaces, from the branches to twigs of every tree

Question 2

Fagaceae, Lauraceae

Cloud Forest Station D – @Lost World
Suggested Solutions

Question 1a *(sample photo)*

Question 1b *(from sample photo)*
Quadrilateral, Pentagon *(depends on polygons chosen)*

Question 2a *(sample photo)*

Question 2b *(from sample photo)*

$$\frac{1}{2} \times (a + b) \times h$$
$$= \frac{1}{2} \times (86 + 124) \times 56$$
$$= 5\,880 \text{ cm}^2$$

Question 3a

Carnivorous plants are found in acidic bags or in rocky locations where sunlight and water are abundant, but where soils are thin and have very low levels of nutrients.

Question 3b

These plants attract, capture and digest their prey to obtain the nutrients that they cannot find in soil.

Question 3c (i)

Snap trap, Suction trap and Active glue trap.

Question 3c (ii)

Pitfall trap, Lobster pot trap and Passive glue trap.

Cloud Forest Station E – @Cloud Walk
Suggested Solutions

Question 1a

To allow rainwater to easily flow down the slope of the dome and collected for various uses.

Question 1b

1. To allow sunlight to pass through for photosynthesis by plants and trees.
2. To reduce the amount of heat from the outside.

Question 2 *(Any two)*

1. Discharge of clean water to the reservoir after cleaning.
2. Irrigation of seedlings and cuttings
3. Irrigation to Conservatories

Cloud Forest Station F – After the Cloud Walk
Suggested Solutions

Question 1

	Rainwater	Electricity	Heat	Reservoir	Irrigate
1) _____ is collected.	◉	○	○	○	○
2) Clean water is discharged to the _____.	○	○	○	◉	○
3) _____ the plants and trees in the Gardens.	○	○	○	○	◉
4) To generate _____.	○	◉	○	○	○
5) Waste _____ is used to regenerate the desiccant used for dehumidifying the domes.	○	○	◉	○	○

Question 2

1. Burning waste plant matter to generate electricity
2. Use sunlight to generate electricity
3. Plants and trees absorb greenhouse gases

Cloud Forest Station G – @Waterfall View
Suggested Solutions

Question 1a

A cloud forest is a generally tropical or subtropical, evergreen, montane, moist forest characterised by a persistent, frequent or seasonal low-level cloud cover, usually at canopy level. (*Source: https://en.wikipedia.org/wiki/Cloud_forest*)

Question 1b

The water from a cloud forest can create caves, feed the plants and start a waterfall.

Question 2

1. Throughfall
2. Stemflow
3. Crown drip
4. Fog drip

Question 3

1%

Cloud Forest Station H – @Crystal Mountain
Suggested Solutions

Question 1a
Calcium carbonate

Question 1b
Carbon dioxide

Question 1c
Bubble the gas through limewater. If the gas is carbon dioxide, the limewater will turn cloudy.

Question 1d
Stalactites hang from the ceiling of a cave while stalagmites grow from the cave floor.

Question 1e
$100 \text{ cm} \div 0.468 \text{ mm}$
$= 1000 \text{ mm} \div 0.468 \text{ mm}$
$= 2137 \text{ years (nearest whole number)}$

Question 2
$10.97 \times 23.77 \times 800 = 208605.52 \text{ m}^2$

Cloud Forest Station I – @Cloud Forest Gallery
Suggested Solutions

Question 1a *(Any two)*

1. Carbon dioxide
2. Methane
3. Nitrous oxide
4. Chlorofluorocarbons
5. Hydrofluorocarbons

(*Source: https://en.wikipedia.org/wiki/Greenhouse_gas*)

Question 1b *(Any two)*

1. Increase in average temperatures
2. Extreme weather events
3. Glacial retreat
4. Rise in sea levels
5. Ocean acidification
6. Extinction of plants and animals.

(*Source: https://www.livescience.com/37057-global-warming-effects.html*)

Question 2

- Through photosynthesis, trees absorb carbon dioxide and thus help to reduce the amounts of greenhouse gases in the atmosphere.
- Trees also cool the local environment through the process of transpiration.

Question 3 *(Any two)*

1. Mining of raw metals and producing metal alloys
2. Production of plastics
3. Deforestation
4. Burning of fossil fuels
5. Land clearance/conversion of land
6. Forest fires
7. Extraction of raw materials

Question 4

1. Energy is produced by
   (i) Solar panels
   (ii) Burning of bio-waste (Ash is used as fertilisers, gas is used to ventilate the domes)
2. Rainwater is also collected and stored for irrigation purposes in the Gardens.

Question 5 *(Any two)*

1. Repair, reuse or recycle where possible
2. Buy LED instead of incandescent light bulbs
3. Plant a tree or donate to a charity that will
4. Choose products with less packaging
5. Drink tap or filtered water as opposed to bottled water
6. Eat less meat and more vegetables
7. Use public transport and share rides
8. Turn off lights and appliances after use
9. Bring a reuseable bag when shopping
10. Take shorter showers to save water